Raspberry PI Based Artificial Vision Assisting System for Blind Persons

A. Neela Madheswari, R. Dinesh Kumar, R. S. Sabarinathan, M. Manikandan

Department of CSE, Mahendra Engineering College, Namakkal, India

Abstract— *The main aim of this paper is to implement a system that will help blind person. This system is used by a RASPBERRY PI circuit to provide for the identification of the objects, the first level localization. It also incorporates additional components to provide more refined location and orientation information. The input process is to capture every object around 10m and it is convert into the output processing in voice command which is adopted in Bluetooth headset which is used by blind people using RASPBERRY PI component.*

Keywords— Raspberry PI, artificial vision, Python, object identification.

I. INTRODUCTION

There are approximately 38 millions of people across the worldwide mainly in developing countries who are blind and visually impaired, over 15 million from India. Blind persons most of the time are withdrawn from the society because they feel that people and the society are prejudiced and they may not be welcomed most of the time [1]. Independent mobility is one of the most pressing problems facing people who are blind. According to data published by World Health Organization in 2014, 285 million people are estimated to be visually impaired worldwide, of whom 39 million are blind and 246 million have low vision. This means that someone in our world goes blind in every five seconds [2]. There are many factors that contribute to the low take-up of electronic travel aids by blind and visually impaired people. Technology does not operate in isolation, it must be considered within the broader context. Users interact with technology to perform tasks within a social, economic, political and physical environment.

Due to the development of modern technology, many different types of navigational aids are now available to assist the blinds [3], [4], [5], [6]. But almost all the systems use sensor devices. The objects can be identified using sensor components. The usage of sensors is expensive and unsuitable for nowadays. The proposed work is an attempt to object identification for blind persons using Raspberry Pi, head phone and camera. Using this work, the size of the system can be reduced. There is no necessary for Internet connectivity and the output through voice makes the process user friendly.

II. SYSTEM ENVIRONMENT

The block diagram of the system is given in Figure 1. There are three main components namely: Raspberry Pi, Camera and Headset.

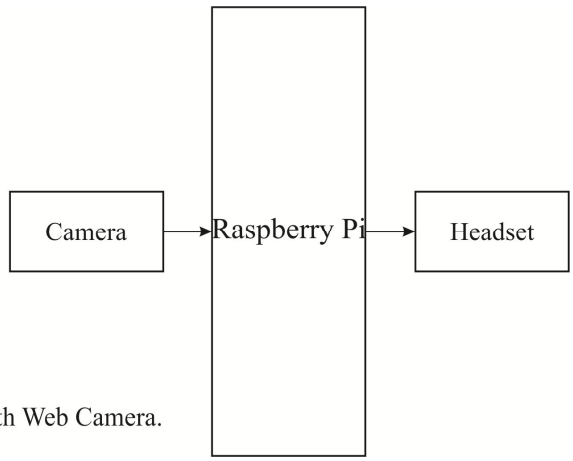

Fig. 1: Block diagram of the proposed system

2.1. Raspberry Pi

The Raspberry Pi is a credit-card sized computer that plugs into your TV and a keyboard, which can be used for many of the things that our average desktop does - spreadsheets, word-processing, games and it also plays high-definition video. Pi is based on a Broadcom SoC (System of Chip) with an ARM processor [~700 MHz], a GPU and 256 to 512 MB RAM. The boot media is an SD card [which is not included], and the SD card can also be used for persist data. RAM and processing power are not nearly close to the power house machines we might have at home, these Pi's can be used as a cheap computer for some basic functions, especially for experiments and education. The Pi comes in three specifications. It is given in Table 1. The cost of a Pi is around $35 for a B Model and is available through many online and physical stores. In this work, Raspberrry Pi Model B is used. The figure 2 shows the architecture of Raspberry Pi Model B.

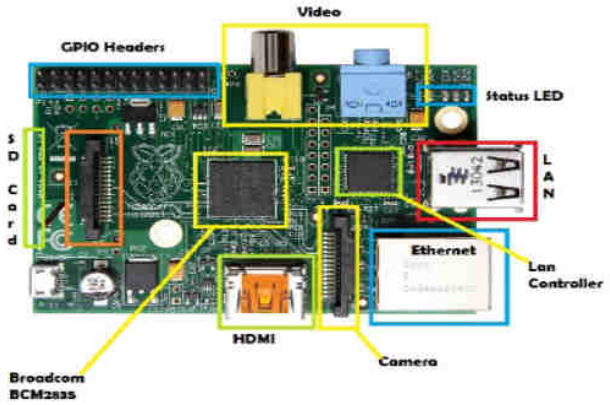

Fig. 2: Raspberry Pi Model B architecture

Table. 1: Raspberry Pi Specifications

Description	Model A	Model B	Model B+
Chip	Broadcom BCM2835 (CPU, GPU, DSP, SDRAM, single USB port)		
Processor	700 MHz ARM1176JZF-S core (ARM11 family, ARMv6 instruction set)		
RAM	256 MB	512 MB	512 MB
USB	1 (direct from BCM2835 chip)	2 on board	4 on board
Storage	SD card	SD card	MicroSD card
Voltage	600mA upto 1.2A@ 5v	750mA upto 1.2A @ 5v	600mA upto 1.8A@ 5v
GPO	26	26	40

2.2. Camera

Camera Pi is an excellent add-on for Raspberry Pi to take pictures and record quality videos with the possibility to apply a considerable range of configurations and effects. Any type of web camera can be used. For example, a web camera shown in figure 3 can also be used for this work.

There are some tools helpful for acquiring images and configuring and obtaining useful information from images. The usage of OpenCV (Open Computer Vision) and SimpleCV (Simple Computer Vision) frameworks that allows simplified usage with Python language. OpenCV is a specific library for computer vision, SimpleCV is usable in Python for easy to use and enhance functionalities of the OpenCV library and image processing algorithms into higher level 'bricks' that simplify the life of the developer that wishes to create artificial vision applications without necessary to possess a deep knowledge of computer vision.

Fig. 3: Web Camera

Using python coding, the steps involved are: i) acquire an image and save in any of the folders, ii) load that particular image, iii) display that image, iv) changes the original picture into black and white without shades of gray, v) desired spots for objects are identified and displayed.

The series of commands to be worked are explained as follows:

1. apt-get update
   It is used to download the package lists from the repositories and updates them to get information on the newest version of packages and their dependencies.
2. apt-get upgrade
   It is used to run the updates and upgrades.
3. raspistill –t 5000
   This will display the previous window for 5 seconds.
4. apt-get install ipython python-opencv python-scipy python-numpy python-setuptools python-pip
5. pip install https://github.com/sightmachine/SimpleCV/zipball/master
   These commands are used to install SimpleCV.
6. pip install svgwrite
   This command is used to install the missing svgwrite python module.
7. simplecv

This command is used to verify the running of SimpleCV. For object identification, the python code written and run was Listatol.py. It is shown in figure 4. We can visualize the objects using Photoshop also for getting clear identification of images. One of the sample object identification processes is given in figure 5. After binarization, the picture will be seen in black and white colours and is shown in figure 6.

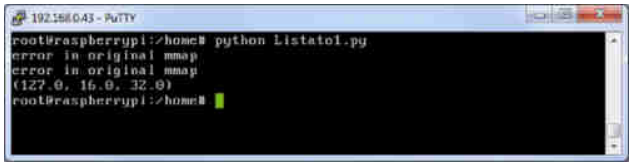

Fig. 4: While running Listatol.py file

Fig. 5: Object identification Process

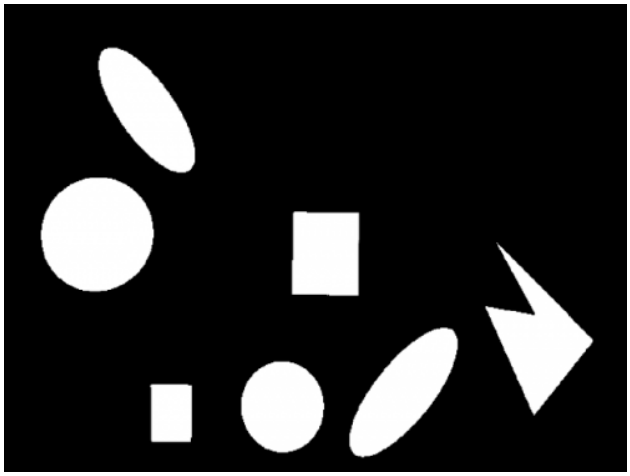

Fig. 6: After binarization

2.3. Head set

Any type of head set can be used for this work. It is used to receive the audio voice generated by the python coding after identification of object to user.

III. OBSERVATIONS

The system is connected as per figure 1. We can use either AC supply or DC supply for Raspberry Pi board. The head phone is connected to Raspberry Pi using one of the USB connectors. Any computer system can be connected to Raspberry Pi using LAN cable through USB connector in Raspberry Pi. Already an Ethernet card is attached with the Raspberry Pi. We can make use of any type of SIM using that Ethernet provision.

First, we have to check the connectivity of the device to the Raspberry board. Then using the remote system execution and connection support and testing, system has to be tested. The entire coding is placed in the SD card and it is to be inserted into the Raspberry Pi board. Then the object which is found near the web camera will be identified.

The sequence of steps involved are: i) ping IP_address_of_device, ii) perform the remote connection device using mstsc command, iii) provide the IP address for remote desktop connection, iv) provide the authentication detail to get into the system, v) run the python coding for obtaining results, vi) Keep the object near to the camera, vii) Object identified and audio played and is also the specified object name is also displayed in the screen.

Using this work, three objects were tested and obtained the results in a correct manner. Those objects are: i) mobile, ii) bottle, iii) ball.

IV. CONCLUSION

The technologies are growing day by day. The usage of technologies for basic needs has to be improved always. This work is a small contribution for object identification which will be helpful for blind persons. In the future, we can extend the work to a many number of objects for identifications and also the image even captured in poor light illumination has also to be identified better.

REFERENCES

[1] Anushree Harsur, Chitra.M, Voice based Navigation System for Blind people using Ultrasonic Sensor, International Journal on Recent and Innovation Trends in Computing and Communication, Vol 3, Issue 6, June 2015, 4117-4122.

[2] Kun Li, Electronic Travel Aids for Blind Guidance, An Industry Landscape Study, Project Report, 2015.

[3] Shachar Maidenbaum, Shlomi Hanassy, Sami Abboud, Galit Buchs, Daniel-Robert Chebat, Shelly Levy-Tzedek, Amir Amedi, The 'Eye Cane', a new electronic travel aid for the blind: Technology, behavior & swift learning, Restorative Neurology and Neuroscience 32 (2014) 813–824.

[4] Manoj Badoni and Sunil Semwal, Discrete Distance and Water Pit Indicator using AVR ATmega8 in Electronic Travel Aid for Blind, International Journal of Disaster Recovery and Business Continuity, vol 2, Nov 2011, 1-8.

[5] Kumar A, Patra R, Manjunatha M, Mukhopadhyay J, An electronic travel aid for navigation of visually impaired persons, Third IEEE International Conference on Communication Systems and Networks (COMSNETS), 2011, 1-5.

[6] Nithya S, Shravani A.S.L, Electronic Eye for Visually Impaired Persons, International Journal of Emerging Technology and Advanced Engineering, Vol 3, Issue 10, Oct 2013, 700-703.